FOREST RESEARCH REPORT

NOVA SCOTIA DEPARTMENT OF LANDS AND FORESTS
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No. 12, March 1989

A COMPARATIVE GROWTH AND YIELD STUDY OF RED AND BLACK SPRUCE PLANTED ON THE SAME SITE

INTRODUCTION

Black spruce *(Picea mariana* (Mill.) B.S.P.) and red spruce *(Picea rubens* Sarg.) are species of major commercial importance in Nova Scotia due to their suitability for both fiber and sawlog production. For this reason, the two species combined accounted for 50% of Nova Scotia's reforestation program in 1987 (30% bS; 20% rS). The silvicultural characteristics of each have been documented extensively, but little is known about their relative growth rates when planted on the same site. Part of the reason for this is the scarcity of older plantations where red and black spruce were planted side by side. In order to provide interim information on their relative growth rates, three red and black spruce plantations located in Nova Scotia were sampled by means of stem analyses.

SITE HISTORY AND METHODS

All three plantations were established on old field sites consisting of sandy-loam textured soils. At Lochaber and Earltown, red and black spruce were planted in alternate blocks; on the third site, at Debert, both species were interplanted.

Planting stock type at each of the sites was bareroot. Silvicultural treatments at Debert and Lochaber consisted of site preparation using a single furrow plough; at Earltown a mechanical tree planter was used.

Information on growth and yield was collected by means of stem analyses. At each site, two or three of the tallest dominant trees for each species were selected, felled and sectioned at stump height (6 in.) and at 4.0 foot intervals. Height, diameter and age were recorded at each section.

FUNDED UNDER CANADA/NOVA SCOTIA FOREST RESOURCE DEVELOPMENT AGREEMENT

Nova Scotia Department of Lands and Forests

Forestry Canada Forêts Canada

RESULTS AND DISCUSSION

Table 1 presents a summary of the stem analyses information. To provide a comparative measure between sites and species, the data are expressed as means.

HEIGHT GROWTH

The height versus age curves (Figure 1) constructed from the stem analyses data indicate that initially black spruce outgrew red spruce at Lochaber and Earltown. In fact, at Earltown black spruce was still slightly taller than red spruce at age 16. However, at Lochaber, red spruce surpassed black spruce in total height by age 21. At Debert, red spruce maintained superior height over its entire 27 years of age. Over all sites, mean red spruce height was 3% greater than black spruce (Table 1).

Table 1. Mean individual tree growth data and land capability by site and species.

Site	Species	LC	Age (yr)	Total Height (ft)	Dbhob (in)	Merch. Volume (ft^3)
Lochaber	bS	7	22	29.3	5.9	2.6
	rS	7	22	29.7	6.9	3.5
% Diff.		-	-	+ 1.3	+ 14.5	+ 26.7
Debert	bS	8	27	38.0	7.4	5.0
	rS	8	27	40.8	7.1	5.8
% Diff.		-	-	+ 6.9	- 4.2	+ 13.5
Earltown	bS	6	16	20.6	4.2	0.9
	rS	6	16	20.1	4.4	1.0
% Diff.		-	-	-2.5	+ 4.5	+ 8.7
All Sites	bS	7	21	29.3	5.8	2.8
	rS	7	21	30.2	6.1	3.4
% Diff.		-	-	+ 3.0	+ 4.9	+ 17.4

LC = Capability of the land to produce wood fibre expressed in m^3/ha/yr, based on the height and age of the tallest dominant trees on the site (NSLF, 1984).
Dbhob = Diameter at breast height outside bark.
Merch. Vol. = Based on inside bark diameter to a 2.8 in. top.

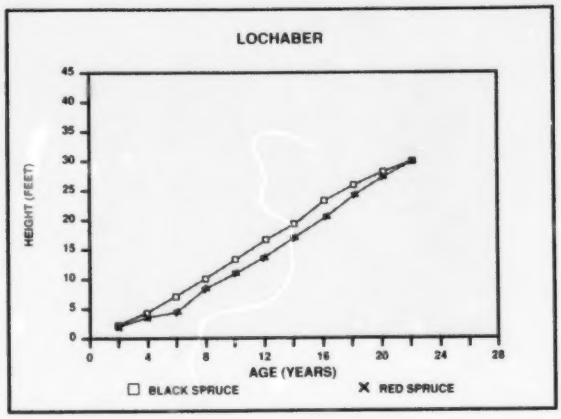
DIAMETER GROWTH

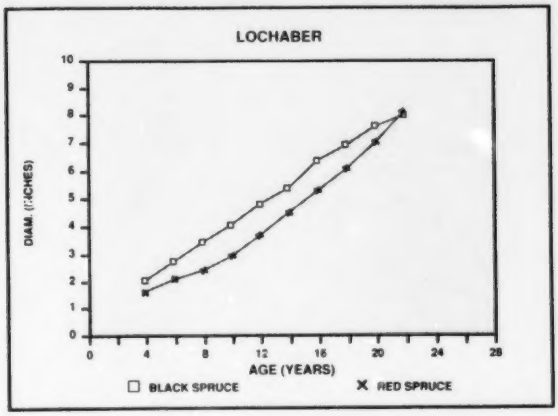
The diameter versus age curves shown in Figure 2 are similar to those of height versus age. Initially, black spruce diameter growth was greater at Lochaber and Earltown, but as the trees at these sites grew older, red spruce caught up to black spruce by ages 14 and 21 respectively. At the third site (Debert), red spruce initially outgrew black and was still larger at age 27. Over all sites, red spruce diameters were 5% greater than black spruce.

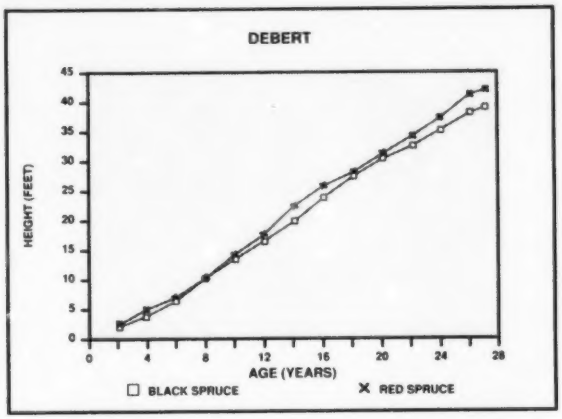
VOLUME GROWTH

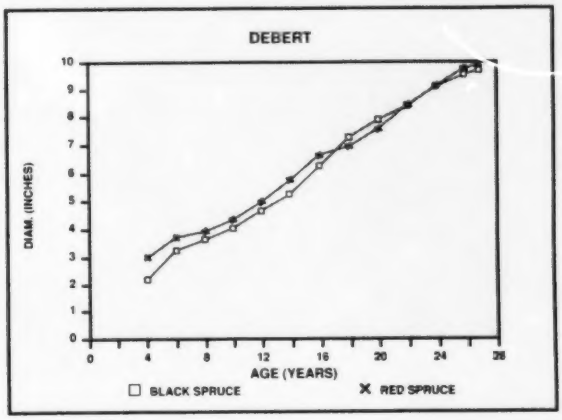
Mean individual tree volumes (merchantable) at Earltown, Debert and Lochaber were calculated to be approximately 9, 14 and 27% greater respectively, for red spruce at 16, 22 and 27 years of age (Table 1). Over all three sites, red spruce produced 17% more volume than black spruce.

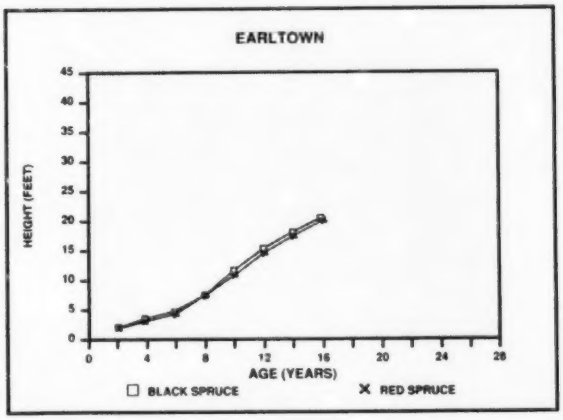
Table 2 compares volume from stem analyses with estimates derived from Honer's Standard Volume Equations (Honer, 1967). In eastern Canada these equations are generally accepted as providing reliable estimates of merchantable volume. Comparison of volume between the two methods revealed differences of 15% for both red and black spruce. In each case the equations underestimated total merchantable volume.











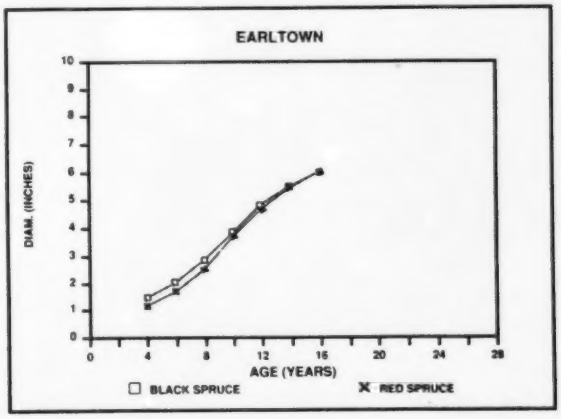


Figure 1. Height/age relationship for red and black spruce on three sites.

Figure 2. Diameter inside bark (breast height)/age relationship for red and black spruce.

Table 2. Estimates of merchantable volume from stem analyses and Honer's Standard Volume Tables for red and black spruce on three sites.

	Red Spruce			Black Spruce		
	Stem Analyses (ft^3)	Honer (ft^3)	Difference (%)	Stem Analyses (ft^3)	Honer (ft^3)	Difference (%)
Lochaber	4.01	4.65	- 15.9	3.02	2.76	+ 8.6
	3.06	3.05	+ 0.3	1.95	1.56	+ 20.0
	3.48	3.60	- 3.4	2.76	2.62	+ 5.1
Debert	6.58	4.98	+ 24.3	5.09	4.84	+ 4.9
	4.98	4.37	+ 12.2	5.19	4.84	+ 6.7
				4.73	4.64	+ 1.9
Earltown	1.02	1.05	- 2.9	1.11	0.91	+ 18.0
	1.23	0.90	+ 26.8	0.79	0.55	+ 30.4
	0.85	0.59	+ 30.6	0.93	0.55	+ 40.9
Average:			+ 14.6			+ 15.2

SUMMARY

1) Dominant red spruce trees exhibited slower growth initially, but had achieved greater height at two of the sites by ages 21 and 27. Overall, mean height for red spruce exceeded black spruce by 3%.
2) At all 3 sites, black spruce achieved greater diameter at an earlier stage of it's development, but red spruce caught up to or surpassed black at ages 16, 22 and 27. Over all sites, red spruce diameters were on average 5% larger.
3) Merchantable volumes per tree were calculated to be 9, 14 and 27% greater for red spruce at Earltown, Debert and Lochaber respectively. Overall, red spruce produced on average 17% more volume than did black spruce.
4) Comparison of volume derived from stem analyses and Honer's Standard Volume Tables revealed differences of 15% for both red and black spruce. In each case Honer's equation underestimated total merchantable volume.

DISCUSSION

In this report, dominant red spruce trees were generally taller than black spruce growing on the same site. This indicates that red spruce can outproduce black spruce, since dominant height (at a given age) is strongly related to capability of the site to produce wood fiber (NSLF, 1984). This study, though, is based on a limited sample of young stands. Therefore, general conclusions regarding the relative long-term productivity of these species are not possible. As additional plantations mature, further sampling on a wider variety of sites will provide the data needed for forming more comprehensive conclusions.

LITERATURE CITED

Honer, T.G. 1967. Standard volume tables and merchantable conversion factors for the commercial tree species of central and eastern Canada. For. Mgt. Res. Inst., Infor. Rept. FMR-X-5, 78 pp.

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